Woods, Penelope D

From: brian moench <drmoench@yahoo.com>
Sent: Tuesday, October 11, 2011 3:12 PM
To: BLM_NV_NVSO_GWProjects
Cc: Woods, Penelope D
Subject: Comments on DEIS on SNWA project
Attachments: References Jan. 2011.rtf

To the Bureau of Land Management:

The Utah Physicians for a Healthy Environment (UPHE) is a volunteer organization of over 200 physicians and consultants from other scientific fields like toxicology, biology, engineering and ecology. Our mission is to protect public health from the consequences of environmental degradation in Utah. UPHE thanks the BLM for the opportunity to comment on the Draft Environmental Impact Statement on SNWA's proposed water pumping project.

There is no more important scientific pursuit within the EIS than the pursuit of empirical information on the impact on public health. To this extent UPHE considers the BLM EIS inadequate, incomplete and in some cases remarkably inaccurate. Some of the BLM's assertions are at such extreme variance with common sense, empirical evidence and established science that this document seriously jeopardizes the BLM's credibility. If the BLM contracted the preparation of this document to a third party that should be disclosed to the public.

In Section 2.13 the EIS asks this question: "What are the controversies associated with this project?" In the BLM's attempt to answer their own question, air quality and health impacts from downwind dust aren't even mentioned. Specifically, air quality impacts on the heavily populated Wasatch Front of Utah is left completely unaddressed. In sharp contrast, construction jobs related to this proposed project are mentioned in the BLM report. That juxtaposition suggests a disturbing bias by the authors of this report and inappropriate priorities. While NEPA does require the disclosure of economic impacts which would include a potential jobs analysis, it also requires a complete disclosure of potential social and environmental impacts of the proposed project, which of course includes potential negative consequences to human populations downwind. This void presents a serious inadequacy in the NEPA analysis.

In Section 4.6 BLM states "The level and extent of these predicted dust emissions are highly uncertain due to the assumptions involving dust increases from changes in vegetation." That suggests to us that the estimates of newly created PM10 dust pollution offered by the BLM--between 24,122 and 34,742 tons per year--could be a significant underestimation by the BLM's own admission. We found nothing in the report indicating the methodology used for that estimation which makes it impossible for members of the public to critique the results.

However, comparisons to the history and the current state of Owens Valley, California are appropriate even if the soils in the Great Basin are not identical to the Owens Valley dry lake bed. The Owens Valley lake bed is 280 km2 and has been estimated to be the source of between 900,000 and 8,000,000 metric tons of PM10 per year (1). The area in the Great Basin that would be dewatered by the proposed SNWA pipeline is approximately 24,000 km2, 857 times larger than the dry Owens Lake. Using the median estimate of Owens Valley based PM10 (4,450,000 tons) yields a value of 15,893 tons of PM10 per km2. By contrast the BLM is estimating a value of one ton of PM10 per km2 from the 24,000 km2 affected by the pipeline. This is, in effect, 16,000 times less dust per sq. km than what has been historically observed by dewatering the Owens Valley. The BLM should explain this enormous discrepancy.

Loss of Great Basin native vegetation will make the Basin even hotter, creating a positive feedback mechanism that will lead to even greater stress on remaining vegetation, further accelerating vegetation die off and increasing the ensuing dust. We see no evidence that this phenomenon has been considered or factored into this EIS.

Even the BLM's absurdly low estimates are alarming enough. To place those figures in context: The entire PM10 annual emissions in Salt Lake County is approximately 18,000 tons. Salt Lake County is the most urbanized and industrialized county in Utah, home to more than one million people and heavy industrial activity like the Rio Tinto's open pit copper mine, numerous gravel pits, power plants and next door to five oil refineries. The BLM's estimation of PM10 emissions from the desertification consequences of this pipeline are 30-100% greater than the entire emissions of Salt Lake County, which have substantial health impacts.

In Chapter 3, Section 3.1 PM10 this statement is made: "Air pollutant concentrations below the standards generally are not considered to be detrimental to public health and welfare." With the current state of research into the public health consequences of air pollution, the most generous way to characterize this statement is that it is naive or decades out of date. Without trying to second guess the motives or expertise of the authors, suffice it to say that the statement contradicts the overwhelming body of scientific research.

There is no safe level of particulate pollution that humans can be exposed to. There is no threshold below which there is no health effect. Even levels that were once thought to be benign, including natural background levels, have been proven to have health consequences. In fact studies have proven that when the signature health outcome of particulate air pollution, sudden cardiac death, is plotted against particulate concentrations, the steepest part of the curve is at the lowest concentrations. In other words, per unit dose of exposure, particulate pollution well below the NAAQS has the greatest health impact.

Attached to these comments is a summary prepared by UPHE of the health impacts of air pollution, organized by organ systems. Bullet points of these impacts on the heart, lungs, brain, chromosomes, fetal and chromosomal development and birth outcomes are given followed by the references supporting these bullet points. There are 205 studies referenced in total, all from

well respected national and international medical journals, many of which establish that this broad array of health impacts are evident at particulate concentrations well below the NAAQS.

Despite the provisions of the Clean Air Act, the history of the EPA's establishment and periodic revisions of the National Ambient Air Quality Standards (NAAQS) demonstrate a strong, indisputable political influence over that process. Throughout the last ten years there have been numerous examples where the recommendations of the EPA's Clean Air Scientific Advisory Committee (CASAC), the scientific experts on the health affects of air pollution, have not been adopted or have been "watered down" by the EPA itself, or other officials in the executive branch. This history alone contradicts the BLM's stated assumption that pollution below federal standards to does not have health impacts.

The BLM's EIS makes this statement: "USEPA regulations allow exceptional events, if properly documented and approved, to be excluded from attainment status designation. An exceptional event refers to high pollution levels caused by a natural or human activity, such as a wildfire or high wind event, which is not reasonably controllable or preventable and is unlikely to reoccur at a particular location." We trust that federal agencies like the BLM and the EPA would consider dust storms originating in the Great Basin, but exacerbated by this pipeline, to be “preventable” and not qualify as “exceptional events.”

In the BLM's document, the only mention of areas in Utah with regard to potential air quality impacts is Tooele, and the statement is made that the nonattainment part of Tooele County is "well outside of the groundwater development areas." We find the omission of any mention of air quality impacts on Utah residents difficult to reconcile.

In Chapter 3, Section 3.1.4.4 the BLM makes an astonishing assertion:

"Most emissions in the PM10 size range will decrease exponentially during downwind transport as they are removed from the atmosphere due to gravitational forces (Hinds 1999). Ultra fine particles, less than 0.1 micron in diameter, are removed from the atmosphere by diffusion to surfaces and also do not travel very far downwind (Hinds 1999). Only a very small fraction of wind erosion emissions from the cumulative project area are expected to be transported into Salt Lake County, Utah, which is over 50 miles from the closest area expected to be impacted by groundwater drawdown."

The evidence of desert dust being transported literally thousands of miles is so extensive that we are indeed perplexed by the BLM's statement. Satellite images show wind-borne dust originating from the Sahara and Gobi deserts of Africa and Asia drifting to South America, the Caribbean and the southern United States (2).

Other commenters, like Terry Marasco, have provided many references that thoroughly contradict the BLM's statement. We also provide our own.

PM10 can be transported more than 1,000 km even in light storms (3). Researchers from the

University of Washington found that dust from the Gobi and Taklimakan deserts in China is routinely present in the air over the western United States (4). The National Weather Service has stated that dust generated in the Gobi Desert affects the air quality and sunsets visible in Utah (5). Researchers from the University of Calif. at Davis using a monitoring station at the top of Donner Summit concluded that most of the particulate pollution measurable over Lake Tahoe originates in China and that one third of it is dust from drought and deforestation (6). NASA has proven that forest fires in Russia and Canada have created a poisonous ring of particulate pollution around the entire planet (7). The pollution plume from forest fires in Alaska have been shown to significantly increase ozone concentrations in Europe (8).

Dust from the southwest has already been shown to hasten the melting of snow in the Rocky Mountains, reducing the amount of runoff into the upper Colorado River by 5%, ultimately causing a loss of 250 billion gallons of water a year (9,10).

Dust from the Sahara Desert is regularly transported to Europe. In fact, a recent study demonstrated that Sahara Desert dust frequently induces exceedances of the European Union's standard for PM10. Furthermore, a study of over 80,000 residents in Rome, Italy revealed increased rates of death from cardiac, respiratory, cerebrovascular and natural causes related to increases in PM10 from Saharan dust outbreaks. The relationship was present even at levels that would have been below the EPA's standards in the United States (11).

The World Health Organization published a 100 page document titled, The Health Risks of Particulate Matter From Long-Range Transboundary Air Pollution. The following excerpts from that document contradict assertions made by the BLM's EIS.

"PM in the size between 0.1 μm and 1 μm can stay in the atmosphere for days or weeks and thus can be transported over long distances in the atmosphere (up to thousands of kilometres). The coarse particles are more easily deposited and typically travel less than 10 km from their place of generation. However, dust storms may transport coarse mineral dust for over 1000 km."

Medical research of the last ten years has identified ultrafine particle pollution as the most dangerous because it travels deeper into body membranes when inhaled, can invade virtually any cell in the body, penetrating cell membranes and creating a chemical toxicity within organelles and the nucleus of the cell (12).

The WHO report goes on to state,"Health effects are observed at all levels of exposure, indicating that within any large population there is a wide range of susceptibility and that some people are at risk even at the lowest end of the observed concentration range." Medical research since this report of 2006 has served to significantly strengthen that contention.

In his book, "The Worst Hard Time", pulitzer prize winner Timothy Egan chronicles the nightmare of the 1930s Dust Bowl, arguably the world's worst environmental disaster. For nine years tsunamis of dust pounded the Great Plains. Sometimes they lasted for weeks at a

time, reached 10,000 feet high and blew as far east as the middle of the Atlantic Ocean. Day after day people had to crawl out their windows to scrape the dirt away from their doors. Abandoned homes disappeared beneath drifts of dirt. Dirt coated every indoor surface. House cleaning literally required a shovel.

People and animals trapped outside in the storms risked blindness or suffocating to death. Woody Guthrie wrote a song about the chronic "dust pneumonia", a lung disease that sickened or killed thousands of Midwesterners, especially children. In some counties one third of all deaths were due to "dust pneumonia."

Heat waves led to plagues of insects. For mile after mile not a single green leaf survived as waves of grasshoppers devoured any plants that survived the weather.

The Dust Bowl had three ingredients: unusual heat, drought and most importantly, land use mismanagement. With roots 18 ft. deep native prairie grasses had kept the soil in place for centuries. But encouraged by ignorant government agencies and greedy real estate speculators, settlers were duped into plowing under native grasses to plant winter wheat that had no chance to survive extreme conditions.

Those same three dust bowl ingredients are now gathering on the horizon of the Great Basin. Scientists say climate change will bring us the heat and drought, worse than 1930s. If the SNWA's piping plan is approved, that will bring to the West the third ingredient of the Dust Bowl, land use mismanagement and consequent loss of critical native vegetation.

In the 1930s the ecological disaster of the Dust Bowl got very little attention in Washington, DC until the dust started affecting the skies and air quality in the Eastern United States (another historical example refuting the BLM's statement about particulate transport). But despite eventual changes in federal land use policies the great Dust Bowl did not end until rain finally returned to the Great Plains. The Great Basin is not likely to see rain undo the damage wrought by draining its aquifers.

The history of Owens Valley and the Aral Sea cannot be ignored when examining the unintended but predictable collateral damage of water diversion. The BLM EIS should have included these historical and real time examples of the consequences of water diversion projects.

The dessicated Owens Lake has become the largest source of particulate air pollution in the United States and has set the record for particulate air pollution measured in the US (13). Keeler, Calif. the nearest town, 60 miles away, experiences particulate pollution that violates the NAAQS about 25 days per year. Dr. Bruce Parker, one of the emergency room physicians at Ridgrecrest Community Hospital made this statement: "When we see the white cloud headed down through the pass, the ER and doctors' offices fill up with people who suddenly got worse. It's a pretty straightforward cause and effect."(13) Additional health considerations consequent to particulate pollution at Owens Valley is high concentrations of

arsenic and other trace metals in the dust, as high as 400 ng/m3.(13)

The history of the diversion of inlet waters to the Aral Sea must also be considered when examining the consequences of the SNWA's proposal. Called one of the world's worst environmental disasters by the UN's Secretary General Ban Ki-Moon, the Aral Sea is now 10% of it original size. Due to increased dust storms generated in the now dry lake bed, respiratory illnesses, including drug resistant tuberculosis, brucellosis, cancer, digestive disorders, anemia, and infectious diseases are now common ailments in the region. Liver, kidney and eye problems can also be attributed to the toxic dust storms. There is an unusually high fatality rate amongst vulnerable parts of the population. There is a high child mortality rate of 75 in every 1,000 newborns and maternity death of 12 in every 1,000 women.

In 2002 the UN estimated that winds carried an average of 200,000 tons of salt and toxic dust every day throughout the Aral Sea region and thousands of miles beyond, as far as Russia's arctic north. The dust is heavily polluted with herbicides, heavy metals, and salt (14,15).

Average life expectancy in the Aral Sea region of Kazakhstan has declined from 64 to 51 years. Reproductive pathologies and adverse pregnancy outcomes are much higher than the rest of the former USSR and present-day Russia. 87% of newborn babies are anemic and 5% have birth defects (16). Health authorities in the area are largely in agreement that the newly formed dust bowl and the toxic chemicals contained in the dust is the primary cause of these disturbing public health trends.

The BLM's EIS makes this assertion: "Erionite has not been identified in the project area and is not expected to be an air contaminant resulting from project activities."

The Great Basin is uniquely suited to the formation of zeolites such as erionite in that a great deal of volcanic ash has accumulated in the valley basins. The permanent saline, alkaline lakes and playas provided the necessary circumstances for the volcanic ash to eventually produce zeolites. For the BLM to state that erionite “has not been identified in the project area” reveals virtually nothing about how much investigation has been conducted and offers no reassurance that this is not a potentially serious health issue.

Erionite was first recognized as a serious health hazard in the 1980s and found to cause the same types of cancer and interstitial fibrosis as asbestos. However, animal experiments suggest that erionite is 300 to 800 times more carcinogenic than asbestos (Cartew et al. 1992). In villages in Turkey contaminated with naturally occurring erionite the rate of cancer is about 1000 times the normal rate. Erionite contaminated gravel in North Dakota has resulted in levels of exposure similar to what was found in Turkish villages ravaged by mesothelioma cancer (17,18,19).

Given the toxicity of erionite, and its known presence in the Great Basin, the residents of the Western US have a right to know the details of the investigation that allows the BLM to conclude that erionite “is not expected to be an air contaminant resulting from project

activities."

The BLM's EIS makes this statement: "There is not anticipated to be re-suspension and transport of radionuclides from past nuclear testing at levels considered to be harmful to human health." Similar to our statement on erionite, UPHE considers this statement unsubstantiated at best and grossly inaccurate at worst.

In 2006 considerable controversy was raised and eventually wide spread public opposition was mounted in Utah against a federal government planned, non-nuclear bomb test in Nevada dubbed "Divine Strake". 10,000 letters of protest were written to the federal government, most expressing opposition to the likelihood of radioactive contaminated dust drifting into Utah. Divine Strake was cancelled due to public opposition and pressure from Utah's Governor Jon Huntsman. SNWA's pumping project represents a much greater radioactive threat.

Over 900 nuclear bomb tests occurred at the Nevada test site in the mid 20th century. The DOE also conducted numerous "safety" experiments that did not produce nuclear explosions but did create significant "surface contamination" with plutonium. Nuclear "rocket tests" added additional radioactive contamination. In terms of cumulative effects, the contamination from above ground testing along with the safety shots and cratering events left an estimated 27,000 acres (42 square miles) of surface soils contaminated at levels in excess of 40 pico curies per gram (20).

Underground tests did not stop until 1992 and the US Dept. of Energy (DOE) admits that of the 723 underground tests that were detonated, at least 114 of them released significant radioactivity into the atmosphere. Other scientists think that number is much higher and in fact think that it is rare that underground testing does not release atmospheric radioactivity. Surface soil contamination from underground tests only added to the radioactivity levels mentioned above.

The DOE has stated that it is not possible to fully define the level of residual contamination that remains from the atmospheric testing program, but admits that radioactive isotopes that are still in Great Basin soil include americium, plutonium, uranium, cobalt, cesium, strontium, and europium (20). Some of these radioactive elements are alpha-emitters, some of the most carcinogenic sustances known. Illustrating this point: since 1943 the military has been aware of the extreme toxicity of uranium as a gas. In a document dated October 30, 1943 and declassified June 5, 1974, three major scientists from the Manhattan Project, Drs. James Conant, A. H. Compton, and H. C. Urey wrote to Brigadier General Leslie R. Groves, who was the head of the atom bomb project, concerning "Radioactive materials as a military weapon." In that document they stated:

"As a gas warfare instrument the material (uranium) would be ground into particles of microscopic size to form dust and smoke and distributed by a ground-fired projectile, land vehicles, or aerial bombs. In this form it would be inhaled by personnel. The amount necessary to cause death to a person inhaling the material is extremely small. It has been estimated that

one millionth of a gram accumulating in a person's body would be fatal. There are no known methods of treatment for such a casualty."

Uranium was also recommended as a permanent terrain contaminant which could be used to destroy populations by contaminating water supplies and agricultural land with radioactive dust (21). One millionth of a gram of uranium yields 1,000 alpha particles per day, each alpha particle carries over 4 million electron volts, and it takes only 6-10 electron volts to break a DNA strand. Because of its mass and energy alpha particles are 20 to 1000 times more dangerous to living tissue than beta or gamma radiation (22).

Some of these radioactive elements also bioconcentrate as they rise up the food chain, reaching concentrations as much as thousands of times higher in meat and milk, including human breast milk. Humans reside at the top of the food chain, especially human embryos.

Once inside the human body these radioactive elements continue to bioconcentrate, accounting for their distinctive carcinogenic patterns and enhancing the toxicity of low dose exposures. Strontium concentrates in bone, bone marrow and teeth, resulting in bone cancers and leukemia. Cesium resembles potassium, which is ubiquitous in every cell. It concentrates in brain, muscle, ovary and testicles, leading to brain cancer, muscle cancers (rhabdomyosarcomas), ovarian and testicular cancer and, most importantly, can mutate genes in the eggs and sperm causing genetic diseases in future generations.

Plutonium is the most deadly of an alpha emitters. If inhaled into the lung it is transported from the lung to thoracic lymph nodes where it can induce Hodgkins disease or lymphoma. Because it is an iron analogue it combines with the iron transporting protein and concentrates in the liver, causing liver cancer, and the bone marrow causing bone cancer, leukemia, or multiple myeloma. It also concentrates in the testicles and ovaries where it can induce testicular or ovarian cancer, and/or mutate genes to induce genetic disease in future generations. Plutonium can cross the placental barrier which protects the embryo. Once lodged within the embryo, one alpha particle could kill a cell that would form the left side of the brain, or the right arm, like thalidomide did years ago. The half-life of plutonium is 24,400 years, so it can cause harm for 500,000 years; inducing cancers, congenital deformities, and genetic diseases for the rest of time, not only in humans, but in all life forms.

There is little doubt that current dust storms from the Great Basin already continue to deliver radioactive isotopes to the environment where millions of Utah residents live. A 2009 masters thesis study was conducted using soil samples from the Washington County area to determine if Cesium 137 still exists in the area in detectable amounts. 102 soil samples were collected and analyzed. Only one of the 102 soil samples did not have detectable amounts of Cesium. The author stated, “Several of the samples contained levels substantially higher than earlier estimates would have predicted. This leads us to conclude that doses to the public from the testing could also have been higher than earlier thought.” (23)

If Cesium 137 is that prevalent in soil in Washington County, Utah, one can assume that it and

other long lived radioactive isotopes would be all the more prevalent in soil in the area affected by this project, which is closer to the Nevada Nuclear Testing Site. Therefore the dust generated by the newly dewatered landscape is almost certainly still radioactive.

The BLM does not appear to appreciate current scientific assessment of the health risks of radioactivity. As with particulate air pollution, science has established that there is no safe level of radioactivity exposure. The National Academy of Sciences Biological Effects of Ionizing Radiation (BEIR) Report VII from 2005 states, "A comprehensive review of available biological and biophysical data supports a “linear-no-threshold” (LNT) risk model, that the risk of cancer proceeds in a linear fashion at lower doses without a threshold and that the smallest dose has the potential to cause a small increase in risk to humans."

Radiation damage is cumulative and each successive dose builds upon the cellular mutation caused by the last. One mutation, in one gene, in a single cell, if unrepaired, can result in a fatal cancer.
Many cancers, especially solid tumors, and other genetic diseases have a latency period of many decades. Utah residents are still showing up with new cancers from the original nuclear testing program decades ago.

Even small increases in risk per person become significant public health hazards in the aggregate, when large numbers of people are exposed. In other words, when millions of people are exposed to slightly increased risks, there will be thousands of new victims.

It should be emphasized that cancer is not the only health risk of radiation exposure. Cardiovascular disease causing heart attacks, strokes and diseases consequent to immunosuppression are all correlated to radiation exposure, as are any diseases related to chromosomal dysfunction, such as birth defects. Children are much more susceptible to radiation caused health affects and human embryos, especially during early gestation, are perhaps thousands of times more at risk for genetic mutations from radiation exposure than are adults. There are over 2,600 diseases described in the medical literature caused by genetic mutations. Mutated genes are passed down from generation to generation in perpetuity, impacting the health of future generations. The BLM EIS makes no differentiation regarding risk among these vastly different population subsets or these thousands of diseases.

This type of detailed radio-biological assessment may be beyond the scope of the BLM’s EIS, but it is a very real factor in determining the health impacts of the SNWA’s project and the residents of Utah certainly deserve that. Without it the BLM has no basis for making statements like “re-suspension and transport of radionuclides are not considered to be harmful to human health.”

To summarize: the radioactive contamination from nuclear testing still present in Great Basin soil and dust has medical ramifications that will never cease. It will affect the health and viability of future generations forever; inducing epidemics of cancer, leukemia and genetic disease. If the BLM has made an actual assessment of concentrations of residual radioactive

isotopes in the surface soil of the pipeline's anticipated affected landscape and/or if modeling has been done to assess public exposure to radioactivity from the ensuing dust, this information should be shared with the public. Unless both of these assessments have been done, the BLM cannot offer any credible opinion about possible health impacts from radioactive isotopes.

On a per weight basis mercury is considered the most toxic substance on earth after plutonium and the most toxic natural heavy metal. Mercury has become a ubiquitous contaminant of the global environment primarily because of industrial emissions from coal power plants and cement production plants. Even higher concentrations of mercury are also likely to be in surface soils in the affected area because it is released during the smelting phase of the numerous gold mine operations in Nevada. Utah already has a severe problem with mercury contamination of its waterways. The Great Salt Lake has one of the highest concentrations of mercury of any inland body of water in the United States (24).

Given the toxicity of mercury, the BLM should have made an assessment of mercury and other heavy metal levels in the soils that will be turned into dust by the project. The Aral Sea history proves the health consequences of dust borne heavy metal exposure. We see no evidence the BLM has made any attempt to assess concentrations of non-radioactive heavy metals in the affected area.

Soils in the Western United States also harbor significant concentrations of microorganisms like the fungal spores that cause Valley Fever (coccidiodomycosis). Valley Fever is a difficult to diagnose, occasionally fatal disease caused by inhalation of these spores. The disease has quadrupled in occurrence in the last ten years in the Southwest. The American Academy of Microbiology estimates that 200,000 people per year contract the disease which is fatal in about one in 1,000 cases. People who are immunosuppressed, women who are pregnant and diabetics are particularly susceptible to serious courses of this disease.

Hotter temperatures allow the cocci a survival advantage over other microorganisms and more frequent and intense dust storms are the perfect delivery system for increasing this infectious disease among residents of the Western US. Dale Griffin, the USGS microbiologist, says one gram of desert soil can contain as many as one billion microorganisms. Fungi can travel long distances because the spore “housing” acts like a cocoon, protecting the fungus from environmental stresses. More than 140 different organisms have been identified as "hitchhiking on to dust particulates (25). SARS, meningitis, influenza and foot and mouth disease are other infectious diseases that can be transmitted by dust.

To summarize: UPHE considers the BLM’s EIS grossly inadequate in assessing the public health impacts of SNWA’s project, especially regarding Utah residents. Prior to a reissuing of the Draft EIS or a supplemental EIS the following should be required:

1. Thorough soil sampling of the entire landscape anticipated to be dewatered must be done, including assessment of the concentrations of all the primary heavy metals, especially mercury, radionuclides, zeolites in general, erionite in particular, and microorganisms, especially

coccidiodomycosis.

2. Depending on the results of the above soil sampling, independent third parties should be employed to make a comprehensive study of the what those concentrations will translate into regarding public health impacts.

3. The methodology used to determine the amount of PM10 dust created by the dewatering of the landscape should be offered to the public and an explanation of why the BLM's estimate is in such sharp contrast to what has been observed in the Owen's Valley and the Aral Sea.

4. Extensive air quality modeling must be done to make a determination of how much of an increase in atmospheric PM2.5 can be expected in various locations in Utah, especially the Wasatch Front.

Should the BLM choose not to reissue the DEIS or conduct a SEIS, then the BLM must choose the No Action Alternative and deny the ROW in order to fulfill its stewardship responsibility to the public and its lands, and especially to protect the public health. UPHE wishes to remind the BLM that the nature of this project means that mistakes made by underestimating public health impacts are likely irreversible, because once the native vegetation has been killed by the drop in ground water levels, there is no reason to believe, and multiple historical examples contradict, SNWA's assurances that more drought tolerant vegetation will take their place. This means the BLM's findings must be thorough, impartial, and most importantly error on the side protecting public health. This current draft fails on all those accounts.

Sincerely,

Brian Moench, MD
President, Utah Physicians for a Healthy Environment
Honors College Faculty, U. of Utah
course instructor, Public Health and the Environment

Cris Cowley, MD
Vice President, Utah Physicians for a Healthy Environment
Chair, Division of Cardiothoracic Anesthesia. Intermountain Medical Center.

Howie Garber, MD
Board Member, UPHE
Emergency Room Physician

Todd C. Seymour
Secretary, UPHE
Staff Anesthesiologist
LDS Hospital

Edward Zamrini, MD
member, UPHE

Stephen Shuput, MD
member, UPHE

Ingrid Nygaard, MD, MS
Professor, Obstetrics and Gynecology
U. of Utah School of Medicine
member, UPHE

Richard Kanner, MD
Professor of Medicine
U. of Utah School of Medicine.
Board member, UPHE
Former Chairman, Utah Air Quality Board

Jennifer Juhl Majersik, MD, MS, FAHA
Assistant Professor, Neurology
Chief, Division of Vascular Neurology
U. of Utah
member, UPHE

Sarah Woolsey MD
member, UPHE

Kathryn J. Swoboda, MD
Associate Professor of Neurology
University of Utah School of Medicine
member, UPHE

Courtney Henley, MD
Staff Anesthesiologist LDS Hospital
member, UPHE

Dr. Debra F. Hobbins, APRN, LSAC.
member, UPHE

Tim Wagner
Board member, UPHE

Jean Arnold
citizen member, UPHE

co-founder of Post Carbon Salt Lake.

Kathy Van Dame, Policy Coordinator
Wasatch Clean Air Coalition
member, UPHE

Marion Klaus, PhD. Biology
member, UPHE

Cherise Udell
Founder, Utah Moms for Clean Air

Marghi E. Barton
citizen member, UPHE

Joanne Payne
citizen member, UPHE

Gerald Mayer,
citizen member UPHE
Engineer ret., Currently Peace Corps Volunteer, Mexico

Mark Thomas
citizen member, UPHE

Don H and Gwendolyn Lee
citizen member, UPHE

References

1. Gill, T. E., and D. A. Gillette, 1991, Owens Lake: A natural laboratory for aridification, playa desiccation and desert dust: Geological Society of America Abstracts with Programs, v. 23, no. 5, p. 462.

2. http://wwwp.dailyclimate.org/tdc-newsroom/valley-fever/Valley-Fever-blowin2019-on-a-hotter-wind

3. Tsoar, H., and K. Pye, 1987, Dust transport and the question of desert loess formation: Sedimentology, v. 34, p. 139-153.

4. http://www.sciencedaily.com/releases 2007/12/071213000427.htm

5. http://www.usatoday.com/weather/news/2001/2001-04-18-asiandust.htm

6. http://www.sierrasun.com/article/20060731/NEWS/60731006

7. http://www.thehindu.com/news/internationalarticle566562.ece

8. Real E, Law K, Weinzier B, Fiebig B, et al. Processes influencing ozone levels in Alaskan forest fire plumes during long-range transport over the North Atlantic. Journal of Geophysical Research D: Atmospheres 112 (2007) D10S41

9. http://latimesblogs.latimes.com/greenspace/2010/09/colorado-river-water-california-dust-grazing.html

10. Painter T, Deems J, Belnap J, Hamlet A, Landry C, Udall B.
Response of Colorado River runoff to dust radiative forcing in snow. PNAS 2010 107 (40) 17125-17130; published ahead of print September 20, 2010, doi:10.1073/pnas.0913139107

11. Mallone S, Stafoggia M, Faustini A, Gobbi GP, Marconi A, Forastiere F. Saharan Dust and Associations between Particulate Matter and Daily Mortality in Rome, Italy. Environ Health Perspect. 2011 Jun 17;119(10):1409-14.

12. Geiser M, Rothen-Rutishauser B, Kapp N, Schürch S, Kreyling W, Schulz H, et al. 2005. Ultrafine Particles Cross Cellular Membranes by Nonphagocytic Mechanisms in Lungs and in Cultured Cells. Environ Health Perspect 113:1555-1560. doi:10.1289/ehp.8006

13. http://geochange.er.usgs.gov/sw/impacts/geology/owens/

14. http://www.columbia.edu/~tmt2120/impacts%20to%20life%20in%20the%20region.htm

15. http://www.reuters.com/article/2008/06/24/idUSL23248577

16. Dr. Oral A. Ataniyazova, M.Sc., the Karakalpak Center for Reproductive Health. Health and Ecological Consequences of the Aral Sea Crisis and Environment, Uzbekistan. Prepared for the 3rd World Water Forum Regional Cooperation in Shared Water Resources in Central Asia. Kyoto, March 18, 2003

17. http://openchannel.msnbc.msn.com/_news 2011/10/07/8190110-health-concerns-grow-over-little-known-mineral

18. Nature 468, 884-885 (2010) | doi:10.1038/468884a. Published online 9 December 2010

19. Carbone M, Barisb Y, Bertinoa P, et al. Erionite exposure in North Dakota and Turkish villages with mesothelioma. PNAS August 16, 2011, vol. 108, no. 33, 13618–13623

20. John B. Walker and Paul J. Liebendorfer. Long-Term Stewardship at the Nevada Test Site. 1998 Nevada Division of Environmental Protection Bureau of Federal Facilities.

21. http://www.mindfully.org/Nucs/Groves-Memo Manhattan30oct43.htm

22. A. Rytz, At. Data and Nucl. Data Tables 47, 205(1991).

23. http://ir.library.oregonstate.edu/xmlui/handle/1957/9293

24. http://articles.latimes.com/2008/aug/10/news/adme-saltlake10

25. http://wwwp.dailyclimate.org/tdc-newsroom/valley-fever/Valley-Fever-blowin2019-on-a-hotter-wind

Woods, Penelope D

From: Gary Kunkel <Gary.Kunkel@hsc.utah.edu>
Sent: Wednesday, October 12, 2011 11:48 AM
To: BLM_NV_NVSO_GWProjects; Woods, Penelope D
Subject: UPHE comments

Sorry for this hassle, but could you please add me to the list of cosigners of UPHE's comments on the draft EIS of SNWA's proposed water pumping project. Many thanks!

Gary Kunkel, MD
Assistant Professor of Medicine
University of Utah

Woods, Penelope D

From: Susan Stewart <susan.ryonen@gmail.com>
Sent: Wednesday, October 12, 2011 2:43 PM
To: Woods, Penelope D
Subject: please add our names to the UPHE's comments

Please include our names in the UPHE's comments.
Susan Stewart and Richard Keene

Woods, Penelope D

From: Utah Valley Earth Forum <Chair@uvef.us>
Sent: Friday, October 21, 2011 6:17 PM
To: BLM_NV_NVSO_GWProjects; Woods, Penelope D
Cc: Brian Moench
Subject: request to join the UPHE letter in opposition to the proposed water transfer

Dear BLM,

This is to request that you add the name the Utah Valley Earth Forum to the list of signers of the UPHE letter in opposition to the use of Utah water to be sent to Las Vegas via a pipeline. We strongly support the Utah Physicians for a Healthy Environments's opposition to the proposed water transfer.

If you have any questions or concerns about our request, please let me know.

With thanks,

James Westwater

James Westwater, Chair

UTAH VALLEY EARTH FORUM

Utah Valley's Citizen Environmental Organization

"Stewardship for a healthy environment"

http://UVEF.us

801-798-2888

Chair@UVEF.us

on Facebook, Blogger and Yahoo (groups)

The Health Consequences of Air Pollution

prepared by
Utah Physicians for a Healthy Environment
Updated Oct., 2011

Pollution and the Cardiovascular System

***The signature physiologic consequence of air pollution is the same as cigarette smoke: a low grade arterial inflammation, arteriolar narrowing, and vascular prothrombotic changes. As with cigarette smoke the effect can be almost immediate and chronic exposure to even low concentrations of pollution are associated with significant arteriolar narrowing.**

***Air pollution causes average blood pressure to increase within minutes. All organs are affected.**

***Rates of heart attacks and strokes increase with air pollution and are the primary cause for increased community mortality rates. Those rates increase within hours after exposure and stay elevated for as long as 30 days after the exposure has ended.**

***Particulate pollution concentrations typical of the Wasatch Front increase mortality rates about 10% according to the formula recommended by the American Heart Association published in May, 2010. That means between 1,000 and 2,000 Utahns die prematurely every year due to our air pollution.**

***Mortality plotted against air pollution concentrations shows no safe threshold, even at low levels, well below EPA national ambient air quality standards (NAAQS). Furthermore this curve is not linear. The steepest part of the curve is at low doses, i.e. small air pollution reductions have even greater public health benefit when the concentrations are already low. A Dutch study demonstrated risks for cardiopulmonary mortality even at what are considered 'background' levels of particulate pollution.**

##############################

1. Brook R, Rajagopalan S, Pope CA, Brook J, Bhatnagar A, et al. AHA Scientific Statement: Particulate Matter Air Pollution and Cardiovascular Disease; An Update to the Scientific Statement From the American Heart Association. Circulation. 2010;121:2331-2378.

2. Peters, A, and Pope, CA III Editorial, Lancet. Vol 360, Oct 19, 2002

3. Pope CA III, Muhlestein JB, May HT et al. Ischemic Heart Disease Events Triggered by Short-term Exposure to Fine Particulate Air Pollution. Circulation 2006, 114:2443-2448.

4. Dockery DW, Stone PH. Cardiovascular Risks from Fine Particulate Air Pollution. NEJM 2007; 356:511-513

5. Miller KA, Siscovick DS, Sheppard L et al. Long-term Exposure to Air Pollution and Incidence of Cardiovascular Events in Women. NEJM 2007; 356:447-458.

6. Peters, A. Air Quality and Cardiovascular Health: Smoke and Pollution Matter. Circulation. 2009: 120:924-927

7. Bruce Urch, Frances Silverman, Paul Corey, Jeffrey R. Brook, Karl Z. Lukic, Sanjay Rajagopalan, and Robert D. Brook. Environ Health Perspect. 2005 August; 113(8): 1052–1055.Acute Blood Pressure Responses in Healthy Adults During Controlled Air Pollution Exposures

8. Peters A, von Klot S, Heier M, et al. Exposure to Traffic and the Onset of Myocardial Infarction. NEJM Vol. 351:1721-1730.

9. Shang-Shyue Tsai, William B. Goggins, Hui-Fen Chiu, and Chun-Yuh Yang. Evidence for an Association Between Air Pollution and Daily Stroke Admissions in Kaohsiung, Taiwan. Stroke 2003;34:2612-2616

10. Eugenia E. Calle and Michael J. Thun C. Arden Pope, III, Richard T. Burnett, Daniel Krewski, Michael Jerrett, Yuanli Shi. Circulation. 2009;120:941-948. Cardiovascular Mortality and Exposure to Airbourne Fine Particulate Matter and Cigarette Smoke.

11. Hoffman B. Presentation, American Thoracic Society (2010, May 17) Higher blood pressure found in people living in urban areas.

12. Kunzil N, Jerrett M, Garcia-Esteban, R, et al. Ambient Air Pollution and the Progression of Atherosclerosis in Adults. PloS ONE, 2010; 2010; 5 (2): e9096 DOI: 10.1371/journal.pone.0009096

13. Pope, CA III, Ezzate, M., Dockery, D. Fine-Particulate Air Pollution and Life Expectancy in the United States. NEJM. Vol. 360:376-386 Jan. 22, 2009 Num. 4.

14. Baccarelli A, Martinelli A, Zanobetti A, et al. Exposure to particulate air pollution and risk of deep vein thrombosis. Arch Intern Med. 2008; 168:920-927

15. Jacobs L, Emmerechts J, Mathieu C, Hoylaerts MF, Fierens F, Hoet PH, Nemery B, Nawrot TS. Air pollution related prothrombotic changes in persons with diabetes. Environ Health Perspect. 2010 Feb;118(2):191-6.

16. Adar SD, Klein R, Klein BE, Szpiro AA, Cotch MF, Wong TY, O'Neill MS, Shrager S, Barr RG, Siscovick DS, Daviglus ML, Sampson PD, Kaufman JD. Air Pollution and the Microvasculature: A Cross-Sectional Assessment of In Vivo Retinal Images in the Population-Based Multi-Ethnic Study of Atherosclerosis (MESA). PLoS Med. 2010 Nov 30;7(11):e1000372

17. Koehoorn M, Davies Gan WQHW, Demers PA, Tamburic L, Brauer M. Long-Term Exposure to Traffic-Related Air Pollution and the Risk of Coronary Heart Disease Hospitalization and Mortality. Environ Health Perspect. 2010 Nov 16. [Epub ahead of print]

18. Bauer M, Moebus S, Möhlenkamp S, Dragano N, Nonnemacher M, Fuchsluger M, Kessler C, Jakobs H, Memmesheimer M, Erbel R, Jöckel KH, Hoffmann B; HNR Study Investigative Group. Urban Particulate Matter Air Pollution Is Associated With Subclinical Atherosclerosis Results From the HNR (Heinz Nixdorf Recall) Study. J Am Coll Cardiol. 2010 Nov 23;56(22):1803-1808.

19. Silverman RA, Ito K, Freese J, Kaufman BJ, De Claro D, Braun J, Prezant DJ. Association of Ambient Fine Particles With Out-of-Hospital Cardiac Arrests in New York City. Am J Epidemiol. 2010 Aug 20. [Epub ahead of print]

20. American College of Cardiology (2008, August 14). Air Pollution Damages More Than Lungs: Heart And Blood Vessels Suffer Too.

21. Katariina Kallio, MD, PhD; Eero Jokinen, MD, PhD; Maiju Saarinen, MSSc; Mauri Hämäläinen, PhD; Iina Volanen, MD, PhD; Tuuli Kaitosaari, MD, PhD; Tapani Rönnemaa, MD, PhD; Jorma Viikari, MD, PhD; Olli T. Raitakari, MD, PhD and Olli Simell, MD, PhD Arterial Intima-Media Thickness, Endothelial Function, and Apolipoproteins in Adolescents Frequently Exposed to Tobacco Smoke. Circulation: Cardiovascular Quality and Outcomes. 2010. Published online before print March 2, 2010, doi: 10.1161/CIRCOUTCOMES.109.857771

22. Federation of American Societies for Experimental Biology (2010, April 28). Mexico City air pollution adversely affects the hearts of young people. ScienceDaily. Retrieved April 29, 2010, from http://www.sciencedaily.com-/releases/2010/04/100428153256.htm

American Heart Association (2010, July 22). Smog might trigger cell death in the heart, study finds. ScienceDaily. Retrieved June 25,

23. Delfino RJ, Tjoa T, Gillen DL, Staimer N, Polidori A, Arhami M, Jamner L, Sioutas C, Longhurst J. Traffic-related air pollution and blood pressure in elderly subjects with coronary artery disease. Epidemiology. 2010 May;21(3):396-404.

24. Urch B, Silverman F, Corey P, Brook J, Lukic K, Rajagopalan S, Brook R. Acute

Blood Pressure Responses in Healthy Adults During Controlled Air Pollution Exposures. Environ Health Perspect. 2005 August; 113(8): 1052–1055.

25. Ruckerl, R. et al. (2007) Air pollution and inflammation (interleukin-6, C-reactive protein, fibrinogen) in myocardial infarction survivors. Environ. Health Perspect. 115, 1072–1080.

26. Pham, H, AC Bonham, KE Pinkerton and CY Chen. 2009. Central neuroplasticity and decreased heart rate variability following particulate matter exposure in mice. Environmental Health Perspectives doi: 10.1289/ehp.0900674.

27. Alexeeff SE, Coull BA, Gryparis A, Suh H, Sparrow D, Vokonas PS, Schwartz J. Medium-Term Exposure to Traffic-Related Air Pollution and Markers of Inflammation and Endothelial Function. Environ Health Perspect. 2011 Feb 24. [Epub ahead of print]

28. Nawrot TS, et al. Heart attacks: Public health importance of triggers of myocardial infaction: a comparative risk assessment. The Lancet, Vol. 377, February 26, 2011, p. 732. DOI: 10.1016/S0140-6736(10)62296-9

29. Davoodi G, Sharif AY, Kazemisaeid A, Sadeghian S, Farahani AV, Sheikhvatan M, Pashang M. Comparison of heart rate variability and cardiac arrhythmias in polluted and clean air episodes in healthy individuals. Environ Health Prev Med. 2010 Jul;15(4):217-21. Epub 2010 Jan 22.

30. Bai N, Kido T, Suzuki H, Yang G, Kavanagh TJ, Kaufman JD, Rosenfeld ME, van Breemen C, Eeden SF. Changes in atherosclerotic plaques induced by inhalation of diesel exhaust. Atherosclerosis. 2011 Mar 2. [Epub ahead of print]

31. Kampfrath T, Maiseyeu A, Ying Z, Shah Z, Deiuliis JA, et al. Chronic Fine Particulate Matter Exposure Induces Systemic Vascular Dysfunction via NADPH Oxidase and TLR4 Pathways. Circulation Research, 2011; 108 (6): 716 DOI: 10.1161/CIRCRESAHA.110.237560

32. Harrison CM, Pompilius M, Pinkerton KE, Ballinger SW 2011. Mitochondrial Oxidative Stress Significantly Influences Atherogenic Risk and Cytokine-Induced Oxidant Production. Environ Health Perspect 119:676-681. doi:10.1289/ehp.1002857

33. Brook RD, Shin HH, Bard RL, Burnett RT, Vette A, Croghan C, et al. 2011. Exploration of the Rapid Effects of Personal Fine Particulate Matter Exposure on Arterial Hemodynamics and Vascular Function during the Same Day. Environ Health Perspect 119:688-694. doi:10.1289/ehp.1002107

34. Sérgio Chiarelli P, Amador Pereira LA, Nascimento Saldiva PH, Ferreira Filho C, Bueno Garcia ML, Ferreira Braga AL, Conceição Martins L. The association between air pollution and blood pressure in traffic controllers in Santo André, São Paulo, Brazil. Environ Res. 2011 May 11. [Epub ahead of print]

35. Chiusolo M, Cadum E, Stafoggia M, Galassi C, Berti G, Faustini A, Bisanti L, Vigotti MA, Dessì MP, Cernigliaro A, Mallone S, Pacelli B, Minerba S, Simonato L, Forastiere F. Short Term Effects of Nitrogen Dioxide on Mortality and Susceptibility Factors in Ten Italian Cities: the EpiAir Study. Environ Health Perspect. 2011 May 17. [Epub ahead of print]

36. Domínguez-Rodríguez A, Abreu-Afonso J, Rodríguez S, Juárez-Prera RA, Arroyo-Ucar E, Jiménez-Sosa A, González Y, Abreu-González P, Avanzas P. Comparative Study of Ambient Air Particles in Patients Hospitalized for Heart Failure and Acute Coronary Syndrome.

37. Brook RD, Shin HH, Bard RL, Burnett RT, Vette A, Croghan C, Thornburg J, Rodes C, Williams R. Exploration of the rapid effects of personal fine particulate matter exposure on arterial hemodynamics and vascular function during the same day. Environ Health Perspect. 2011 May;119(5):688-94.

38. Mallone S, Stafoggia M, Faustini A, Gobbi GP, Marconi A, Forastiere F 2011. Saharan Dust and Associations between Particulate Matter and Daily Mortality in Rome, Italy. Environ Health Perspect. doi:10.1289/ehp.1003026

39. Nuvolone D, Balzi D, Chini M, Scala D , Giovannini F, and Barchielli A . Short-Term Association Between Ambient Air Pollution and Risk of Hospitalization for Acute Myocardial Infarction: Results of the Cardiovascular Risk and Air Pollution in Tuscany (RISCAT) Study. American Journal of Epidemiology Volume174, Issue1Pp. 63-71.

40. Williams R, Brook R, Bard R, Conner T, Shin H, Burnett R. Impact of personal and ambient-level exposures to nitrogen dioxide and particulate matter on cardiovascular function. Int J Environ Health Res. 2011 Jun 28. [Epub ahead of print]

41. Mills NL, Miller MR, Lucking AJ, Beveridge J, Flint L, Boere AJ, Fokkens PH, Boon NA, Sandstrom T, Blomberg A, Duffin R, Donaldson K, Hadoke PW, Cassee FR, Newby DE. Combustion-derived nanoparticulate induces the adverse vascular effects of diesel exhaust inhalation. European Heart Journal, July 13, 2011 DOI:10.1093/eurheartj/ehr195

42. Fattore E, Paiano V, Borgini A, Tittarelli A, Bertoldi M, Crosignani P, Fanelli R. Human health risk in relation to air quality in two municipalities in an industrialized area of Northern Italy. Environ Res. 2011 Jul 15. [Epub ahead of print]

43. Meyer G, Boissiere J, Tanguy S, Rugale C, Gayrard S, Jover B, Obert P, Reboul C. Carbon Monoxide Pollution Impairs Myocardial Perfusion Reserve: Implication of Coronary Endothelial Dysfunction. Cardiovasc Toxicol. 2011 Jul 27. [Epub ahead of print].

44. Ayotte, P, A Carrier, N Ouellet, V Boiteau, B Abdous, EAL Sidi, ML Château-Degat and E Dewailly. 2011. Relation between methylmercury exposure and plasma paraoxonase activity in Inuit adults from Nunavik. Environmental Health Perspectives http://dx.doi.org/10.1289/ehp.1003296.

45. Chen R, Pan G, Zhang Y, Xu Q, Zeng G, Xu X, Chen B, Kan H. Ambient carbon monoxide and daily mortality in three Chinese cities: The China Air Pollution and Health Effects Study (CAPES). Sci Total Environ. 2011 Sep 10. [Epub ahead of print]

46. Van Hee VC, Szpiro AA, Prineas R, Neyer J, Watson K, Siscovick D, Park SK, Kaufman JD.
Association of Long-term Air Pollution With Ventricular Conduction and Repolarization Abnormalities.
Epidemiology. 2011 Sep 13. [Epub ahead of print]

47. Breitner S, Liu L, Cyrys J, Brüske I, Franck U, Schlink U, Leitte AM, Herbarth O, Wiedensohler A, Wehner B, Hu M, Pan XC, Wichmann HE, Peters A. Sub-micrometer particulate air pollution and cardiovascular mortality in Beijing, China. Sci Total Environ. 2011 Sep 20. [Epub ahead of print]

48. Bhaskaran K, Hajat S, Armstrong B, Haines A, Herrett E, Wilkinson P, Smeeth L. The effects of hourly differences in air pollution on the risk of myocardial infarction: case crossover analysis of the MINAP database. BMJ. 2011 Sep 20;343:d5531. doi: 10.1136/bmj.d5531.

49. Weichenthal S, Kulka R, Dubeau A, Martin C, Wang D, Dales R 2011. Traffic-Related Air Pollution and Acute Changes in Heart Rate Variability and Respiratory Function in Urban Cyclists. Environ Health Perspect 119:1373-1378. http://dx.doi.org/10.1289/ehp.1003321

50. Szyszkowicz M, Rowe BH, Brook RD. Even Low Levels of Ambient Air Pollutants Are Associated With Increased Emergency Department Visits for Hypertension. Can J Cardiol. 2011 Sep 23. [Epub ahead of print]

51. Perepu RS, Dostal DE, Garcia C, Kennedy RH, Sethi R. Cardiac dysfunction subsequent to chronic ozone exposure in rats. Mol Cell Biochem. 2011 Sep 27. [Epub ahead of print]

52. Van Hee VC, Szpiro AA, Prineas R, Neyer J, Watson K, Siscovick D, Kyun Park S, Kaufman JD.
Association of Long-term Air Pollution With Ventricular Conduction and Repolarization Abnormalities. Epidemiology. 2011 Nov;22(6):773-780.

Pollution and the Brain

*** The systemic inflammation caused by air pollution also affects the brain**

*** Air pollution components reach the brain and can penetrate deeply into the parenchyma**

*** Many of the compounds adsorbed to particulate matter are neurotoxic**

*** Air pollution causes CNS oxidative stress, neuroinflammation, neuronal damage, cortical stress measured by EEG, enhancement of Alzheimer type-abnormal filamentous proteins, BBB changes, and cerebrovascular damage. Many of these changes can be found in children and young adults.**

*** Greater air pollution exposure is associated with lower intelligence and poorer motor function in children, decreased cognition in adults, higher rates of strokes, multiple sclerosis, autism, Parkinson's and other neurodegenerative diseases.**

##############################

1. Calderon-Garciduenas L, Mora-Tiscareno A, Ontiveros E, et al. Air pollution, cognitive deficits and brain abnormalities: a pilot study with children and dogs. Brain Cogn. 2008 Nov;68(2):117-27. Epub 2008 Jun 11..

2. Calderon-Garciduenas L, Solt AC, et al. Lon-term air pollution exposure is associated with neuroinflammation, an altered innate immune response, disruption of the blood-brain barrier, ultrafine particulate deposition, and accumulation of amyloid beta-42 and alpha-synuclein in children and young adults. Toxicol Pathol. 2008;36(2):289-310. Epub 2008 Mar 18

3. Calderon-Garciduenas L, Franco-Lira M, Torres-Jardon R. Pediatric Respiratory and Systemic Effects of Chronic Air Pollution Exposure: Nose, Lung, Heart, and Brain Pathology. Toxicol Pathol, Vol. 35, No1, 154-162 (2007)

4. Hartz A, Bauer B, Block M, Diesel exhaust particles induce oxidative stress, proinflammatory signaling, and P-glycoprotein, up-regulation at the blood-brain barrier. The FASEB Journal 2008;22:2723-2733.

5. Cruts B, van Etten L, Tornquvist H, et al. Exposure to diesel exhaust induces changes in EEG in human volunteers. Part Fibre Toxicol. 2008;5:4. March11. dol:1186/1743-8977-5-4.

6. Suglia SF, et al. Association of Black Carbon with Cognition among Children in a Prospective Birth Cohort Study Am J Epidemiology 2008 167:280-286.

7. Wang, Z., Zeng, X, Zeng, Y, Wang, S. Chen, S. Association of traffic-related air pollution with children’s neurobehavioral functions in Quanzhou, China. Environ Health Perspect. 2009 Oct; 117 (10):1612-8 Epub. 2009 May 11.

8. Volk H, Hertz-Picciotto I, Delwiche L , Lurmann F, McConnell R. Residential Proximity to Freeways and Autism in the CHARGE study. Environ Health Perspect. 2010 Dec 13. [Epub ahead of print] PMID: 21156395.

9. Morales, E., Julvez, J., Torrent, M., et al. Association of Early-life Exposure to Household Gas Appliances and Indoor Nitrogen Dioxide With Cognition and Attention Behavior in Preschoolers. American Journal of Epidemiology 2009 169(11):1327-1336;

10. Suzuki, T., Oshio, S., Iwata, M., et al. In utero exposure to a low concentration of diesel exhaust affects spontaneous locomotor activity and monoaminergic system in male mice. Particle and Fibre Toxicology 2010, 7:7doi:10.1186/1743-8977-7-7

11. Freire, C., Ramos, R., Puertas, R., et al. Association of traffic-related air pollution with cognitive development in children. J Epidemiol Community Health 2010;64:223-228

12. Edwards SC, Jedrychowski W, Butscher M, Camann D, Kieltyka A, Mroz E, et al. 2010. Prenatal Exposure to Airborne Polycyclic Aromatic Hydrocarbons and Children's Intelligence at Age 5 in a Prospective Cohort Study in Poland. Environ Health Perspect :-. doi:10.1289/ehp.0901070

13. Calderón-Garcidueñas L, Reed W, Maronpot RR, Henríquez-Roldán C, Delgado-Chavez R, Calderón-Garcidueñas A, Dragustinovis I, Franco-Lira M, Aragón-Flores M, Solt AC, Altenburg M, Torres-Jardón R, Swenberg JA. Brain inflammation and Alzheimer's-like pathology in individuals exposed to severe air pollution. Toxicol Pathol. 2004 Nov-Dec;32(6):650-8.

14. Power MC, Weisskopf MG, Alexeeff SE, Coull BA, Spiro Iii A, Schwartz J. Traffic-Related Air Pollution and Cognitive Function in a Cohort of Older Men. Harvard School of Public Health. Environ Health Perspect. 2010 Dec 20. [Epub ahead of print]

15. G. Oberdörster, Z. Sharp, V. Atudorei, A. Elder, R. Gelein, W. Kreyling and C. Cox. Translocation of Inhaled Ultrafine Particles to the Brain. Inhalation Toxicology 2004, Vol. 16, No. 6-7, Pages 437-445

16. Perera, FP, L Zhigang, R Whyatt, L Hoepner, S Wang, D Camann and V Rauh. 2009. 2009. Prenatal airborne polycyclic aromatic hydrocarbon exposure and child IQ at age 5 years. Pediatrics doi: 10.1542/peds.2008-3506.

17. Lopez I, Beltran-Parrazal1 L, Abhimanyu Amarnani A. Evidence for oxidative stress in the developing cerebellum of the rat after chronic mild carbon monoxide exposure (0.0025% in air) BMC Neuroscience 2009, 10:53doi:10.1186/1471-2202-10-53

18. Zhou Z, Yuan T, Chen Y, Qu L, Rauh V, Zhang Y, Tang D, Perera F, Li T. Benefits of Reducing Prenatal Exposure to Coal-Burning Pollutants to Children's Neurodevelopment in China Research Article, published 14 Jul 2008 | doi:10.1289/ehp.11480

19. Thomson, E.M. et al. (2007) Air pollution alters brain and pituitary endothelin-1 and inducible nitric oxide synthase gene expression. Environ. Res. 105, 224233

20. Peters, A. et al. (2006) Translocation and potential neurological effects of fine and ultrafine particles a critical update. Part. Fibre Toxicol. 3, 13

21. Hong, Y.C. et al. (2002) Air pollution: a new risk factor in ischemic stroke mortality. Stroke 33, 2165–2169

22. Kettunen, J. et al. (2007) Associations of fine and ultrafine particulate air pollution with stroke mortality in an area of low air pollution levels. Stroke 38, 918–922

23. Calderon-Garciduenas, L. et al. (2002) Air pollution and brain damage. Toxicol. Pathol. 30, 373–389

24. Calderon-Garciduenas, L. et al. (2003) DNA damage in nasal and brain tissues of canines exposed to air pollutants is associated with evidence of chronic brain inflammation and neurodegeneration. Toxicol. Pathol. 31, 524–538

25. Mateen F, Brook R. Air Pollution as an Emerging Global Risk Factor for Stroke JAMA. 2011;305(12):1240-1241.doi:10.1001/jama.2011.352

26. Lopez IA, Acuna D, Beltran-Parrazal L, Lopez IE, Amarnani A, Cortes M, Edmond J. Evidence for oxidative stress in the developing cerebellum of the rat after chronic mild carbon monoxide exposure (0.0025% in air) BMC Neuroscience 2009, 10:53 (27 May 2009)

27. Morgan TE, Davis DA, Iwata N, Tanner JA, Snyder D, Ning Z, et al. 2011. Glutamatergic Neurons in Rodent Models Respond to Nanoscale Particulate Urban Air Pollutants In Vivo and In Vitro. Environ Health Perspect :-. doi:10.1289/ehp.1002973

28. Gackière F, Saliba L, Baude A, Bosler O, Strube C. Ozone inhalation activates stress-responsive regions of the central nervous system. J Neurochem. 2011 Apr 6. doi: 10.1111/j.1471-4159.2011.07267.x. [Epub ahead of print]
.
29. Calderón-Garcidueñas L, D'Angiulli A, Kulesza RJ, Torres-Jardón R, Osnaya N, Romero L, Keefe S, Herritt L, Brooks DM, Avila-Ramirez J, Delgado-Chávez R, Medina-Cortina H, González-González LO. Air pollution is associated with brainstem auditory nuclei pathology and delayed brainstem auditory evoked potentials. Int J Dev

Neurosci. 2011 Mar 31. [Epub ahead of print]

30. Power MC, Weisskopf MG, Alexeeff SE, Coull BA, Spiro A III, Schwartz J 2011. Traffic-Related Air Pollution and Cognitive Function in a Cohort of Older Men. Environ Health Perspect 119:682-687. doi:10.1289/ehp.1002767

31. Fonken LK, Xu X, Weil ZM, Chen G, Sun Q, Rajagopalan S, Nelson RJ. Air pollution impairs cognition, provokes depressive-like behaviors and alters hippocampal cytokine expression and morphology. Molecular Psychiatry, 2011; DOI: 10.1038/mp.2011.76

32. Levesque S, Surace MJ, McDonald J, Block ML. Air pollution and the brain: Subchronic diesel exhaust exposure causes neuroinflammation and elevates early markers of neurodegenerative disease. J Neuroinflammation. 2011 Aug 24;8(1):105. [Epub ahead of print]

33. Guxens M, Aguilera I, Ballester F, Estarlich M, Fernández-Somoano A, Lertxundi A, Lertxundi N, Mendez MA, Tardón A, Vrijheid M, Sunyer J. Prenatal Exposure to Residential Air Pollution and Infant Mental Development: Modulation by Antioxidants and Detoxification Factors. Environ Health Perspect. 2011 Aug 25. [Epub ahead of print]

34. Calderón-Garcidueñas L, Kavanaugh M, Block M, D'Angiulli A, Delgado-Chávez R, Torres-Jardón R, González-Maciel A, Reynoso-Robles R, Osnaya N, Villarreal-Calderon R, Guo R, Hua Z, Zhu H, Perry G, Diaz P. Neuroinflammation, Alzheimer's Disease-Associated Pathology, and Down-Regulation of the Prion-Related Protein in Air Pollution Exposed Children and Young Adults.
J Alzheimers Dis. 2011 Sep 28. [Epub ahead of print]

35. Lopez I, Acuna D, Beltran-Parrazal L, et al. Evidence for oxidative stress in the developing cerebellum of the rat after chronic mild carbon monoxide exposure (0.0025% in air). BMC Neuroscience 2009, 10:53doi:10.1186/1471-2202-10-53

http://www.sciencenews.org/view/feature/id/58906/title/Destination_brain

##

Pollution and Chromosomal/Fetal Development

*** Pregnant women exposed to more air pollution give birth to babies with significantly more chromosomal aberrations and epigenetic changes which can be passed on to multiple subsequent generations.**

*** Exposure even to brief episodes of pollution at critical stages in the**

development of the human embryo can cause a person to experience an increased likelihood of multiple chronic diseases including those of the heart, lungs, immune system and brain and even obesity, diabetes and cancer.

*** Air pollution breathed by a pregnant mother causes epigenetic changes in the womb, which is associated with higher rates of asthma and decreased lung function in those children 5 years later.**

*** Exposure to intermittent air pollution is associated with sperm DNA damage and consequent increase in the rates of male infertility, miscarriages and other adverse reproductive outcomes.**

##############################

1. Bruner-Tran, KL and KG Osteen. 2010. Developmental exposure to TCDD reduces fertility and negatively affects pregnancy outcomes across multiple generations. Reproductive Toxicology http://dx.doi.org/10.1016/j.reprotox.2010.10.003

2. Rodríguez-Trigo G, Zock J-P, Pozo-Rodríguez F, Gómez, F, et al. Health Effects in Fishermen 2 Years After Assisting With Oil Spill Clean-up Ann Intern Med October 19, 2010 153:I-28; published ahead of print August 23, 2010.

3. Perera F, Tang W, Herbstman J. Relation of DNA Methylation of 5-CpG Island of ACSL3 to Transplacental Exposure to Airborne PAH and Childhood Asthma.. PloS ONE. Feb. 16, 2009.

4. Hansen C, Barnett A, Prichard G. The Effect of Ambient Air Pollution during Early Pregancy on Fetal Ultrasound Measurements during Mid-Pregnancy. Environ Health Persp Vol. 116, Number 3, March 2008.

5. Bocskay K, Tang D, Orjuela M, et al. Chromosomal Aberrations in Cord Blood Are Associated with Prenatal Exposure to Carcinogenic Polycyclic Aromatic Hydrocarbons. Cancer Epidem Biomarkers and Prev. Vol. 14, 506-511, Feb 2005

6. Perera F, Tang D, Tu Y, Biomarkers in Maternal and Newborn Blood Indicate Heightened Fetal Susceptibility to Procarcinogenic DNA Damage. Environ Health Persp Vol 112 Number 10 July 2004

7. Pilsner JR, Hu H, Ettinger A, Sanchez BN, et al. Influence of prenatal lead exposure on genomic methaylation of cord blood DNA. Environ Health Persp, April 2009

8. Baccarelli A. Breathe deeply into your genes!: genetic variants and air pollution effects.., Am J Respir Crit Care Med. 2009 Mar 15;179(6):431-2.

9. Baccarelli A, Wright RO, Bollati V, Tarantini L, Litonjua AA, Suh HH, Zanobetti A,

Sparrow D, Vokonas PS, Schwartz J. Rapid DNA methylation changes after exposure to traffic particles. Am J Respir Crit Care Med. 2009 Apr 1;179(7):523-4.

10. Huang YC, Schmitt M, Yang Z, Que LG, Stewart JC, Frampton MW, Devlin RB. Gene expression profile in circulating mononuclear cells after exposure to ultrafine carbon particles. Inhal Toxicol. 2010 May 27. [Epub ahead of print]

11. Jedrychowski WA, Perera FP, Maugeri U, Mroz E, Klimaszewska-Rembiasz M, Flak E, Edwards S, Spengler JD. Effect of prenatal exposure to fine particulate matter on ventilatory lung function of preschool children of non-smoking mothers. Paediatr Perinat Epidemiol. 2010 Sep;24(5):492-501.

12. Thomson E, Kumarathasn P, Calderon-garcidueas L, Vincent R. Air pollution alters brain and pituitary endothelin-1 and inducible nitric oxide synthase gene expressions Environmental Research 2007, vol. 105, no2, pp. 224-233 [10 page(s) (article)] (1 p.1/2)

13. Pedersen M, Wichmann J, Autrup H, Dang DA, Decordier I, Hvidberg M, Bossi R, Jakobsen J, Loft S, Knudsen LE. Increased micronuclei and bulky DNA adducts in cord blood after maternal exposures to traffic-related air pollution. Environ Res. 2009 Nov;109(8):1012-20. Epub 2009 Sep 23.

14. Herr CE, Dostal M, Ghosh R, Ashwood P, Lipsett M, Pinkerton KE, Sram R, Hertz-Picciotto I. Air pollution exposure during critical time periods in gestation and alterations in cord blood lymphocyte distribution: a cohort of livebirths. Environ Health. 2010 Aug 2;9(1):46.

15. Gonzalez-Pina, R. et al. (2008) Prenatal exposure to ozone disrupts cerebellar monoamine contents in newborn rats. Neurochem. Res. 33, 912–918

16. Yan Zhong, Steven G. Carmella, Pramod Upadhyaya, J. Bradley Hochalter, Diane Rauch, Andrew Oliver, Joni Jensen, Dorothy Hatsukami, Jing Wang, Cheryl Zimmerman, Stephen S. Hecht. Immediate Consequences of Cigarette Smoking: Rapid Formation of Polycyclic Aromatic Hydrocarbon Diol Epoxides. Chemical Research in Toxicology, 2010; 101227010050010 DOI: 10.1021/tx100345x

17. Perera FP 2008. Children Are Likely to Suffer Most from Our Fossil Fuel Addiction. Environ Health Perspect 116:987-990. doi:10.1289/ehp.11173

18. Rubesa J, Rybara R, Prinosilovaa P, Veznika Z, et al. Genetic polymorphisms influence the susceptibility of men to sperm DNA damage associated with exposure to air pollution. Mutation Research 683 (2010) 9–15.

19. Rubes J, Selevan S, Evenson D, Zudova D, Vozdova M, Zudova Z, Robbins W, Perreault S. Episodic air pollution is associated with increased DNA fragmentation in human sperm without other changes in semen quality. Human

Reproduction Vol.20, No.10 pp. 2776–2783, 2005 doi:10.1093/humrep/dei122. Advance Access publication June 24, 2005.

20. Zhong Y, Carmella S, Upadhyaya P, Hochalter JB, etal. Immediate Consequences of Cigarette Smoking: Rapid Formation of Polycyclic Aromatic Hydrocarbon Diol Epoxides Chem. Res. Toxicol., Article ASAP DOI: 10.1021/tx100345x Publication Date (Web): December 27, 2010

21. Topinka J, Rossner P Jr, Milcova A, Schmuczerova J, Svecova V, Sram RJ. DNA Adducts and Oxidative DNA Damage Induced by Organic Extracts From PM2.5 in an Acellular Assay. Toxicol Lett. 2011 Feb 14. [Epub ahead of print]

(Industrial PM2.5 is more genotoxic and causative of oxidative stress than traffic PM2.5)

22. Madrigano J, Baccarelli A, Mittleman MA, Wright RO, Sparrow D, Vokonas PS, Tarantini L, and Schwartz J. Prolonged exposure to particulate pollution, genes associated with glutathione pathways, and DNA methylation in a cohort of older men. Environmental Health Perspectives http://dx.doi.org/10.1289/ehp.1002773.

23. Oh SM, Park YR, Kim HR, Park YJ, Kim MJ, Son BH, Lee MJ, Lee SY, Chung KH. Organic extracts of urban air pollution particulate matter (PM2.5)-induced genotoxicity and oxidative stress in human lung bronchial epithelial cells (BEAS-2B cells). Mutat Res. 2011 Apr 16. [Epub ahead of print]

24. Han X, Zhou N, Cui Z, Ma M, Li L, Cai M, et al. 2011. Association between Urinary Polycyclic Aromatic Hydrocarbon Metabolites and Sperm DNA Damage: A Population Study in Chongqing, China. Environ Health Perspect 119:652-657. doi:10.1289/ehp.1002340

25. Gualtieri M, Ovrevik J, Mollerup S, Asare N, Longhin E, Dahlman HJ, Camatini M, Holme JA.
Airborne urban particles (Milan winter-PM2.5) cause mitotic arrest and cell death: Effects on DNA, mitochondria, AhR binding and spindle organization. Mutat Res. 2011 May 30. [Epub ahead of print]

26. Oya E, Ovrevik J, Arlt VM, Nagy E, Phillips DH, Holme JA. DNA damage and DNA damage response in human bronchial epithelial BEAS-2B cells following exposure to 2-nitrobenzanthrone and 3-nitrobenzanthrone: role in apoptosis. Mutagenesis. 2011 Jun 29. [Epub ahead of print]

27. Abbas I, Garçon G, Saint-Georges F, Andre V, Gosset P, Billet S, Goff JL, Verdin A, Mulliez P, Sichel F, Shirali P. Polycyclic aromatic hydrocarbons within airborne particulate matter (PM(2.5)) produced DNA bulky stable adducts in a human lung cell coculture model. J Appl Toxicol. 2011 Sep 13. doi: 10.1002/jat.1722. [Epub ahead of print]

28. Zhang A, Hu H, Sánchez BN, Ettinger AS, Park SK, Cantonwine D, et al. 2011. Association between Prenatal Lead Exposure and Blood Pressure in Female Offspring. Environ Health Perspect :-. http://dx.doi.org/10.1289/ehp.1103736

Current Opinion in Pediatrics:
April 2009 - Volume 21 - Issue 2 - p 243-251
doi: 10.1097/MOP.0b013e32832925cc
Therapeutics and toxicology: Edited by Robert O. Wright
Epigenetics and environmental chemicals
Baccarelli, Andrea; Bollati, Valentina

http://www.newsweek.com/2010/10/30/how-your-experiences-change-your-sperm-and-eggs.html

##

Pollution and the Lung

*** Air pollution permanently inhibits lung growth in children.**

*** Brief exposure to ozone and particulate matter reduce lung function even in young healthy adults and the reduction can last for a week after the pollution exposure is over.**

*** Air pollution causes lung cancer.**

*** Long term ozone exposure causes an increase in overall mortality in addition to that from particulate matter. Most of the mortality is respiratory.**

*** Air pollution exacerbates virtually all pulmonary diseases and likely plays a causative role in reactive airways disease.**

*** Air pollution is associated with increased rates of hospitalization and death from respiratory diseases from neonates to the elderly**

*** The correlation between the above health outcomes and ozone are still found at concentrations between one half and one third the current EPA NAAQS**

##############################

1. Schelegle, E., Morales, C., Walby, W., et al, 6.6 Hour Inhalation of Ozone Concentrations from 60 to 87 Parts per Billion in Healthy Humans. American Journal of Respiratory and Critical Care Medicine Vol 180. pp 265-272, (2009).

2. Thaller, E., Petronella, S., Hochman, D. et al. Moderate increases in Ambient PM 2.5 and Ozone Are Associated With Lung Function Decreases in Beach Lifeguards. Journal of Occupational and Environmental Medicine. 50(2):202-211, Feb. 2008.

3. Gauderman WJ, Gilliland GF, Vora H, et al. Association between Air Pollution and Lung Function Growth in Southern California Children: results from a second cohort. Am J Respir Crit Care Med 2002;166:76-84.

4. Gauderman WJ, Gilliland GF, Vora H, et al. The effect of air pollution on lung development from 10 to 18 years of age. NEJM 2004;351:1057-67.

5. Wichmann et al. Increased asthma and respiratory symptoms in children exposed to petrochemical pollution. Journal of Allergy and Clinical Immunology, 2009; 123 (3): 632 DOI: 10.1016/j.jaci.2008.09.052

6. Jerrett M, Burnett R, Pope CA, et al. Long-Term Ozone Exposure and Mortality. NEJM. Vol. 360:1085-1095. March 12, 2009 Num 11.

7. Zuurbier M, Hoek G, Oldenwening M, Meliefste K, van den Hazel P, Brunekreef B. Respiratory Effects of Commuters' Exposure to Air Pollution in Traffic. Epidemiology. 2011 Jan 11. [Epub ahead of print]

8. Faustini A, Stafoggia M, Berti G, Bisanti L, Chiusolo M, Cernigliaro A, Mallone S, Primerano R, Scarnato C, Simonato L, Vigotti MA, Forastiere F; The relationship between ambient particulate matter and respiratory mortality: a multi-city study in Italy. Eur Respir J. 2011 Jan 13. [Epub ahead of print]

9. Forbes LJ, Kapetanakis V, Rudnicka AR, Cook DG, Bush T, Stedman JR, Whincup PH, Strachan DP, Anderson HR. Chronic exposure to outdoor air pollution and lung function in adults. Thorax. 2009 Aug;64(8):657-63. Epub 2009 Apr 8.

10. Chong S Kim1*, Neil E Alexis2, Ana G Rappold1, Howard Kehrl1, Milan J Hazucha2, John C Lay2, Mike T Schmitt1, Martin Case1, Robert B Devlin1, David B Peden2, and David Diaz-Sanchez1 Lung Function and Inflammatory Responses in Healthy Young Adults Exposed to 0.06 ppm Ozone for 6.6 Hours. Published ahead of print on January 7, 2011. Am. J. Respir. Crit. Care Med. 2011, doi:10.1164/rccm.201011-1813OC

11. Steinvil A, Fireman E, Kordova-Biezuner L, Cohen M, Shapira I, Berliner S, Rogowski O. Environmental air pollution has decremental effects on pulmonary function test parameters up to one week after exposure. Am J Med Sci. 2009 Oct;338(4):273-9.

12. Catherine J. Karr, Paul A. Demers, Mieke W. Koehoorn, Cornel C. Lencar, Lillian Tamburic, and Michael Brauer. Influence of Ambient Air Pollutant Sources on Clinical

Encounters for Infant Bronchiolitis. Am. J. Respir. Crit. Care Med., Nov 2009; 180: 995 - 1001.

13. Hollingsworth, J.W. et al. (2007) Ozone and pulmonary innate immunity. Proc. Am. Thorac. Soc. 4, 240–246

14. Strickland M, Darrow L, et al. Short Term Associations between Ambient Air Pollutants and Pediatric Asthma Emergency Department Visits. Am J Respir Crit Care Med Vol 182 pp307-316, 2010

15. Stafoggia M, Forastiere F, et al. Susceptibility Factors to Ozone Related Mortality Am J Respir Crit Care Med Vol 182 pp 376-384, 2010

16. Bell ML, Peng RD, Dominici F. The exposure-response curve for ozone and risk of mortality and the adequacy of current ozone regulations. Environ Health Perspect 2006;114:532-536.

17. Mushtaq N, Ezzati M, Hall L, Dickson I, Kirwan M, Png KM, Mudway IS, Grigg J. Adhesion of Streptococcus pneumoniae to human airway epithelial cells exposed to urban particulate matter. J Allergy Clin Immunol. 2011 Jan 17. [Epub ahead of print]

18. Andersen Z, Hvidberg M, Jensen S, et al. Chronic Obstructive Pulmonary Disease and Long-Term Exposure to Traffic-Related Air Pollution: A Cohort Study. Am. J. Respir. Crit. Care Med. 2010, doi:10.1164/rccm.201006-0937OC. Published ahead of print on September 24, 2010

19. Raaschou-Nielsen O, Andersen Z, Hvidberg M, Jensen SS, Ketzel M, Sørensen M, et al. 2011. Lung Cancer Incidence and Long-Term Exposure to Air Pollution from Traffic. Environ Health Perspect :-. doi:10.1289/ehp.1002353

20. Spira-Cohen A, Chen L-C, Kendall M, Lall R, Thurston GD 2011. Personal Exposures to Traffic-Related Air Pollution and Acute Respiratory Health Among Bronx School Children with Asthma. Environ Health Perspect :-. doi:10.1289/ehp.1002653

21. Franck U, Herbarth O, Röder S, Schlink U, Borte M, Diez U, Krämer U, Lehmann I.Respiratory effects of indoor particles in young children are size dependent. Sci Total Environ. 2011 Feb 10. [Epub ahead of print]

22. Minelli C, Wei I, Sagoo G, Jarvis D, Shaheen S, Burney P. Interactive Effects of Antioxidant Genes and Air Pollution on Respiratory Function and Airway Disease: A Huge Review. Am J Epidemiol. 2011 Feb 22. [Epub ahead of print].

23. N. Li, J. R. Harkema, R. P. Lewandowski, M. Wang, L. A. Bramble, G. R. Gookin, Z. Ning, M. T. Kleinman, C. Sioutas, A. E. Nel. Ambient Ultrafine Particles Provide a Strong Adjuvant Effect in the Secondary Immune Response: Implication for Traffic-related Asthma Flares. AJP: Lung Cellular and Molecular Physiology, 2010; DOI:

10.1152/ajplung.00115.2010

24. Nawrot TS, Vos R, Jacobs L, Verleden SE, Wauters S, Mertens V, Dooms C, Hoet PH, Van Raemdonck DE, Faes C, Dupont LJ, Nemery B, Verleden GM, Vanaudenaerde BM. The impact of traffic air pollution on bronchiolitis obliterans syndrome and mortality after lung transplantation. Thorax. 2011 Mar 23. [Epub ahead of print]

25. Son J-Y, Bell ML, Lee J-T 2011. Survival Analysis of Long-Term Exposure to Different Sizes of Airborne Particulate Matter and Risk of Infant Mortality Using a Birth Cohort in Seoul, Korea. Environ Health Perspect 119:725-730. doi:10.1289/ehp.1002364

26. Zuurbier, M, G Hoek, M Oldenwening, K Meliefste, P van den Hazel and B Brunekreef. 2011. Respiratory effects of commuters' exposure to air pollution in traffic. Epidemiology http://dx.doi.org/10.1097/EDE.0b013e3182093693.

27. Factor P, Akhmedov AT, McDonald JD, Qu A, Wu J, Jiang H, Dasgupta T, Panettieri Jr RA, Perera F, Miller RL. Polycyclic Aromatic Hydrocarbons Impair {beta}2AR Function in Airway Epithelial and Smooth Muscle Cells. Am J Respir Cell Mol Biol. 2011 May 26. [Epub ahead of print]

28. Pope CA 3rd, Burnett RT, Turner MC, Cohen AJ, Krewski D, Jerrett M, Gapstur SM, Thun MJ.
Lung Cancer and Cardiovascular Disease Mortality Associated with Ambient Air Pollution and Cigarette Smoke: Shape of the Exposure-Response Relationships. Environ Health Perspect. 2011 Jul 19. [Epub ahead of print]

29. Peters S, Kromhout H, Olsson AC, Wichmann HE, Brüske I, Consonni D, Landi MT, Caporaso N, Siemiatycki J, Richiardi L, Mirabelli D, Simonato L, Gustavsson P, Plato N, Jöckel KH, Ahrens W, Pohlabeln H, Boffetta P, Brennan P, Zaridze D, Cassidy A, Lissowska J, Szeszenia-Dabrowska N, Rudnai P, Fabianova E, Forastiere F, Bencko V, Foretova L, Janout V, Stücker I, Dumitru RS, Benhamou S, Bueno-de-Mesquita B, Kendzia B, Pesch B, Straif K, Brüning T, Vermeulen R.
Occupational exposure to organic dust increases lung cancer risk in the general population.
Thorax. 2011 Aug 19. [Epub ahead of print]

30. Peel JL, Klein M, Flanders WD, Mulholland JA, Freed G, Tolbert PE 2011. Ambient Air Pollution and Apnea and Bradycardia in High-Risk Infants on Home Monitors. Environ Health Perspect 119:1321-1327. http://dx.doi.org/10.1289/ehp.1002739

31. Chiusolo M, Cadum E, Stafoggia M, Galassi C, Berti G, Faustini A, et al. 2011. Short-Term Effects of Nitrogen Dioxide on Mortality and Susceptibility Factors in 10 Italian Cities: The EpiAir Study. Environ Health Perspect 119:1233-1238. http://dx.doi.org/10.1289/ehp.1002904

32. Andersen ZJ, Bønnelykke K, Hvidberg M, Jensen SS, Ketzel M, Loft S, Sørensen M, Tjønneland A, Overvad K, Raaschou-Nielsen O. Long-term exposure to air pollution and asthma hospitalisations in older adults: a cohort study. Thorax. 2011 Sep 2. [Epub ahead of print]

33. Esplugues A, Ballester F, Estarlich M, Llop S, Fuentes-Leonarte V, Mantilla E, Vioque J, Iñiguez Outdoor, but not indoor, nitrogen dioxide exposure is associated with persistent cough during the first year of life. C.Sci Total Environ. 2011 Sep 1. [Epub ahead of print]

34. Franzi LM, Bratt JM, Williams KM, Last JA. Why is particulate matter produced by wildfires toxic to lung macrophages? Toxicol Appl Pharmacol. 2011 Sep 16. [Epub ahead of print].

35. Turner MC, Krewski D, Pope Iii CA, Chen Y, Gapstur SM, Thun MJ. Long-Term Ambient Fine Particulate Matter Air Pollution and Lung Cancer in a Large Cohort of Never Smokers. Am J Respir Crit Care Med. 2011 Oct 6. [Epub ahead of print]

36. Kim J, Natarajan S, Vaickus LJ, Bouchard JC, Beal D, Cruikshank WW, Remick DG. Diesel Exhaust Particulates Exacerbate Asthmalike Inflammation by Increasing CXC Chemokines. Am J Pathol. 2011 Sep 30. [Epub ahead of print]

##

Pollution and Birth Outcomes

*** Air pollution causes morphologic changes in the placenta, inhibiting blood transfer to the fetus**

*** Pregnant women exposed to more air pollution have multiple adverse pregnancy outcomes including higher rates of pre-eclampsia, intrauterine growth retardation, premature births, low birth wt. syndrome and neonates with smaller head circumference**

***Air pollution is associated with higher rates of birth defects including neural tube and cardiac birth defects**

##############################

1. Forbes LJ, Kapetanakis V, Rudnicka AR, Cook DG, Bush T, Stedman JR, Whincup PH, Strachan DP, Anderson HR. Nascimento LF, Moreira DA. Are environmental pollutants risk factors for low birth weight? Cad Saude Publica. 2009 Aug;25(8):1791-6.

2. van den Hooven EH, de Kluizenaar Y, Pierik FH, Hofman A, van Ratingen SW, Zandveld PY, Mackenbach JP, Steegers EA, Miedema HM, Jaddoe VW. Air Pollution, Blood Pressure, and the Risk of Hypertensive Complications During Pregnancy: The Generation R Study. Hypertension. 2011 Jan 10. [Epub ahead of print]

3. Yorifuji T, Naruse H, Kashima S, Ohki S, Murakoshi T, Takao S, Tsuda T, Doi H. Residential Proximity to Major Roads and Preterm Births. Epidemiology. 2010 Nov 3. [Epub ahead of print].

4. Lupo, PJ, E Symanski, DK Waller, MA Canfield and LE Mitchellet. 2010. Maternal exposure to ambient levels of benzene and neural tube defect among offspring, Texas, 1999-2004. Environmental Health Perspectives http://dx.doi.org/10.1289/ehp.1002212.

5. Rahman, Anisur. Arsenic Exposure and Risk of Spontaneous Abortion, Stillbirth, and Infant Mortality. Epidemiology. November 2010 - Volume 21 - Issue 6 - pp 797-804 doi: 10.1097/EDE.0b013e3181f56a0d

6. Bell ML, Belanger K, Ebisu K, Gent JF, Lee HJ, Koutrakis P, Leaderer BP. Prenatal Exposure to Fine Particulate Matter and Birth Weight: Variations by Particulate Constituents and Sources. Epidemiology. 2010 Aug 31. [Epub ahead of print]

7. Suzuki, T., Oshio, S., Iwata, M., et al. In utero exposure to a low concentration of diesel exhaust affects spontaneous locomotor activity and monoaminergic system in male mice. Particle and Fibre Toxicology 2010, 7:7doi 10.1186/1743-8977-7-7

8. Veras MM, Damaceno-Rodregues N, Caldini E, Ribeiro A, et al. Particulate Urban Air Pollution Affects the Functional Morphology of Mouse Placenta. Biology of Reproduction Sept. 1, 2008 vol. 79 no. 3 578-584.

9. Hansen C, Barnett A, Prichard G. The Effect of Ambient Air Pollution during Early Pregancy on Fetal Ultrasound Measurements during Mid-Pregnancy. Environ Health Persp Vol. 116, Number 3, March 2008

10. Wu J, Ren C, Delfino RJ, Chung J, Wilhelm M, Ritz B 2009. Association between Local Traffic-Generated Air Pollution and Preeclampsia and Preterm Delivery in the South Coast Air Basin of California. Environ Health Perspect 117:1773-1779. doi:10.1289/ehp.0800334

11. Ritz B, Yu F, Fruin S, Chapa G, Shaw G, Harris J. Ambient Air Pollution and Risk of Birth Defects in Southern California. Am. J. Epidemiol. (2002) 155(1): 17-25 doi:10.1093/aje/155.1.17

12. Vrijheid M, Martinez D, Manzanares S, Dadvand P, Schembari A, Rankin J, Nieuwenhuijsen M. Environ Health Perspect. 2010 Dec 3. [Epub ahead of print] Ambient Air Pollution and Risk of Congenital Anomalies: A Systematic Review and

Meta-Analysis.

13. Dadvand P, Rankin J, Rushton S, Pless-Mulloli T. Ambient air pollution and congenital heart disease; a register-based study. Environ Res. 2011 Feb 15. [Epub ahead of print]

14. M. Estarlich, et al. Residential exposure to outdoor air pollution during pregnancy and anthropometric measures at birth in a multicenter cohort in spain. Environmental Health Perspectives, in press. Posted online March 23, 2011. doi: 10.1289/ehp.1002918

15. Hwang BF, Lee YL, Jaakkola JJ. Air Pollution and Stillbirth: A Population-Based Case-Control Study in Taiwan. Environ Health Perspect. 2011 Mar 28. [Epub ahead of print]

16. Lee PC, Talbott EO, Roberts JM, Catov JM, Sharma RK, Ritz B. Particulate Air Pollution Exposure and C-reactive Protein During Early Pregnancy. Epidemiology. 2011 Apr 21. [Epub ahead of print]

17. Darrow LA, Klein M, Strickland MJ, Mulholland JA, Tolbert PE 2011. Ambient Air Pollution and Birth Weight in Full-Term Infants in Atlanta, 1994–2004. Environ Health Perspect 119:731-737. doi:10.1289/ehp.1002785

18. Salihu HM, August EM, Mbah AK, Alio AP, de Cuba R 2nd, Jaward FM, Berry EL. Effectiveness of a Federal Healthy Start Program in Reducing the Impact of Particulate Air Pollutants on Feto-Infant Morbidity Outcomes. Matern Child Health J. 2011 Jul 17. [Epub ahead of print]

19. Wilhelm M, Ghosh JK, Su J, Cockburn M, Jerrett M, Ritz B. Traffic-Related Air Toxics and Term Low Birth Weight in Los Angeles County, California. Environ Health Perspect. 2011 Aug 11. [Epub ahead of print]

20. Hwang B-F, Lee YL, Jaakkola JJ 2011. Air Pollution and Stillbirth: A Population-Based Case–Control Study in Taiwan. Environ Health Perspect 119:1345-1349. http://dx.doi.org/10.1289/ehp.1003056

21. Estarlich M, Ballester F, Aguilera I, Fernández-Somoano A, Lertxundi A, Llop S, et al. 2011. Residential Exposure to Outdoor Air Pollution during Pregnancy and Anthropometric Measures at Birth in a Multicenter Cohort in Spain. Environ Health Perspect 119:1333-1338. http://dx.doi.org/10.1289/ehp.1002918

22. Pereira G, Nassar N, Cook A, Bow C. Traffic emissions are associated with reduced fetal growth in areas of Perth, Western Australia: an application of the AusRoads dispersion model. Australian and New Zealand Journal of Public Health. Volume 35, Issue 5, pages 451–458, October 2011

23. Wilhelm M, Ghosh JK, Su J, Cockburn M, Jerrett M, Ritz B. Traffic-related air

toxics and preterm birth: a population-based case-control study in Los Angeles County, California. Environmental Health 2011, 10:89 doi:10.1186/1476-069X-10-89

##

Miscellaneous Health Consequences

***Air pollution is associated with higher rates of breast cancer, lung cancer, childhood leukemia, diabetes, immune suppression, bacterial infections, lupus, juvenile arthritis, infant mortality, sleep apnea, and suicide**

***Air pollution causes systemic oxidative stress, cytotoxicity, and penetrates intracellular structures**

*** Air pollution accelerates the aging process and shortens the lengths of telomeres**

################################

1. Raaschou-Nielsen O, Andersen Z, Hvidberg M, Jensen SS, Ketzel M, Sørensen M, Loft S, Overvad K, Tjønneland A. Lung Cancer Incidence and Long-Term Exposure to Air Pollution from Traffic. Environ Health Perspect. 2011 Jan 12. [Epub ahead of print]

2. Bernatsky, S, M Fournier, CA Pineau, AE Clarke, E Vinet and A Smargiassi. 2010. Associations between ambient fine particulate levels and disease activity in systemic lupus erythematosus (SLE). Environmental Health Perspectives http://dx.doi.org/10.1289/ehp.1002123.

3. Pearson J, Bachireddy C, Shyamprasad S, Goldfine A, Brownstein J. Association Between Fine Particulate Matter and Diabetes Prevalence in the U.S.Diabetes Care October 2010 33:2196-2201; published ahead of print July 13, 2010, doi:10.2337/dc10-0698

4. Krämer U, Herder C, Sugiri D, Strassburger K, Schikowski T, Ranft U, et al. 2010. Traffic-related Air Pollution and Incident Type 2 Diabetes: Results from the SALIA Cohort Study. Environ Health Perspect :-. doi:10.1289/ehp.0901689

5.Puett RC, Hart JE, Schwartz J, Hu FB, Liese AD, Laden F 2011. Are Particulate Matter Exposures Associated with Risk of Type 2 Diabetes? Environ Health Perspect 119:384-389. doi:10.1289/ehp.1002344

6. Dietert RR, JC DeWitt, DR Germolec and JT Zelikoff. 2010. Breaking patterns of environmentally influenced disease for health risk reduction: Immune perspectives. Environmental Health Perspectives http://dx.doi.org/10.1289/ehp.1001971.

7. Crouse DL, Goldberg MS, Ross NA, Chen H, Labrèche F 2010. Postmenopausal Breast Cancer Is Associated with Exposure to Traffic-Related Air Pollution in Montreal, Canada: A Case–Control Study. Environ Health Perspect 118:1578-1583. doi:10.1289/ehp.1002221

8. Pearson RL, Wachtel H, Ebi KL. Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers. J Air Waste Manag Assoc 50(2):175-180.

9. Weng HH, Tsai SS, Chen CC, Chiu HF, Wu TN, Yang CYJ. Childhood leukemia development and correlation with traffic air pollution in Taiwan using nitrogen dioxide as an air pollutant marker. Toxicol Environ Health A. 2008;71(7):434-8.

10. Langholz B, et al.; Traffic density and the risk of childhood leukemia in a Los Angeles case-control study. Ann. Epi. 2002 Oct; 12(7):482-7.

11. Kaplan G, Dixon E, Panaccione R, Fong A, Chen L, et al. Effect of ambient air pollution on the incidence of appendicitis. Published online ahead of print October 5, 2009 CMAJ 10.1503/cmaj.082068

12. Bae S, Pan X-C, Kim S-Y, Park K, Kim Y-H, Kim H, et al. 2010. Exposures to Particulate Matter and Polycyclic Aromatic Hydrocarbons and Oxidative Stress in Schoolchildren. Environ Health Perspect 118:579-583. doi:10.1289/ehp.0901077

13. Geiser M, Rothen-Rutishauser B, Kapp N, Schürch S, Kreyling W, Schulz H, et al. 2005. Ultrafine Particles Cross Cellular Membranes by Nonphagocytic Mechanisms in Lungs and in Cultured Cells. Environ Health Perspect 113:1555-1560. doi:10.1289/ehp.8006

14. Dioni L, Hoxha M, Nordio F, Bonzini M, Tarantini L, Albetti B, Savarese A, Schwartz J, Bertazzi PA, Apostoli P, Hou L, Baccarelli A. Effects of Short-Term Exposure to Inhalable Particulate Matter on Telomere Length, Telomerase Expression and Telomerase Methylation in Steel Workers. Environ Health Perspect. 2010 Dec 17. [Epub ahead of print]

15. Raaschou-Nielsen O, Andersen Z, Hvidberg M, Jensen SS, Ketzel M, Sørensen M, et al. 2011. Lung Cancer Incidence and Long-Term Exposure to Air Pollution from Traffic. Environ Health Perspect :-. doi:10.1289/ehp.1002353

16. Zeft AS, Prahala S, Lefevre S, et al. Juvenile idiopathic arthritis and exposure to fine particulate air pollution. Clin Exp Rheumotol 2009 Sep-Oct; 27(5):877-84

17. Zanobetti A, Redline S, Schwartz J, et al. Associations of PM 10 with sleep and sleep-disordered breathing in adults from seven US urban areas. Am J Respir Crit Care Med 2010 Sept 15;182(6):819-25

18. Kim C, et al. Ambient Particulate Matter as a Risk Factor for Suicide. Am J Psychiatry, Sep 2010; 167: 1100 - 1107.

19. Kuo C, Chen V, Lee W, et al. Asthma and Suicide Mortality in Young People: A 12-Year Follow-Up Study. Am J Psychiatry, Sep 2010; 167: 1092 - 1099.

20. Scheers H, Mwalili SM, Faes C, Fierens F, Nemery B, Nawrot TS 2011. Does Air Pollution Trigger Infant Mortality in Western Europe? A Case-Crossover Study. Environ Health Perspect :-. doi:10.1289/ehp.1002913

21. Luo J, Margolis K, Wactawski-Wende J, et al. Association of active and passive smoking with risk of breast cancer among postmenopausal women: a prospective cohort study. BMJ 2011; 342:d1016

22. Amigou A, Sermage-Faure C, Orsi L, Leverger G, Baruchel A, Bertrand Y, et al. 2011. Road Traffic and Childhood Leukemia: The ESCALE Study (SFCE). Environ Health Perspect 119:566-572. doi:10.1289/ehp.1002429

23. McCracken J, Baccarelli A, Hoxha M, Dioni L, Melly S, Coull B, Suh H, Vokonas P, Schwartz J. Annual ambient black carbon associated with shorter telomeres in elderly men: Veterans Affairs Normative Aging Study. Environ Health Perspect. 2010 Nov;118(11):1564-70.

24. Xu Z, Xu X, Zhong M, Hotchkiss IP, Lewandowski RP, Wagner JG, Bramble LA, Yang Y, Wang A, Harkema JR, Lippmann M, Rajagopalan S, Chen LC, Sun Q. Ambient Particulate Air Pollution Induces Oxidative Stress and Alterations of Mitochondria and Gene Expression in Brown and White Adipose Tissues. Part Fibre Toxicol. 2011 Jul 11;8(1):20. [Epub ahead of print]

25. Raaschou-Nielsen O, Andersen ZJ, Hvidberg M, Jensen SS, Ketzel M, Sorensen M, Hansen J, Loft S, Overvad K, Tjonneland A. Air pollution from traffic and cancer incidence: a Danish cohort study. Environ Health. 2011 Jul 19;10(1):67. [Epub ahead of print]

26. Chiu HF, Tsai SS, Chen PS, Liao YH, Liou SH, Wu TN, Yang CY. Traffic air pollution and risk of death from gastric cancer in taiwan: petrol station density as an indicator of air pollutant exposure.
J Toxicol Environ Health A. 2011 Sep 15;74(18):1215-24.

27. Lodovici M, Bigagli E. Oxidative stress and air pollution exposure. J Toxicol. 2011;2011:487074. Epub 2011 Aug 13.

28. Risom L, Møller P, Loft S. Oxidative stress-induced DNA damage by particulate air pollution.
Mutat Res. 2005 Dec 30;592(1-2):119-37. Epub 2005 Aug 8.

29. Williams L, Ulrich CM, Larson T, Wener MH, Wood B, Chen-Levy Z, Campbell PT, Potter J, McTiernan A, De Roos AJ. Fine Particulate Matter (PM(2.5)) Air Pollution and Immune Status Among Women in the Seattle Area. Arch Environ Occup Health. 2011 Jul-Sep;66(3):155-65.

30. Wisnivesky JP, Teitelbaum SL, Todd AC, Boffetta P, Crane M, Crowley L, de la Hoz RE, Dellenbaugh C, Harrison D, Herbert R, Kim H, Jeon Y, Kaplan J, Katz C, Levin S, Luft B, Markowitz S, Moline JM, Ozbay F, Pietrzak RH, Shapiro M, Sharma V, Skloot G, Southwick S, Stevenson LA, Udasin I, Wallenstein S, Landrigan PJ. Persistence of multiple illnesses in World Trade Center rescue and recovery workers: a cohort study. Lancet. 2011 Sep 3;378(9794):888-97.

31. Jordan HT, Brackbill RM, Cone JE, Debchoudhury I, Farfel MR, Greene CM, Hadler JL, Kennedy J, Li J, Liff J, Stayner L, Stellman SD. Mortality among survivors of the Sept 11, 2001, World Trade Center disaster: results from the World Trade Center Health Registry cohort. Lancet. 2011 Sep 3;378(9794):879-87.